

CHEMISTRY 302

ORGANIC CHEMISTRY II

Course Description: The focus of this semester of Introductory Organic Chemistry is the reinforcement of structure/property relationships, curved arrow convention, and the marriage of electronic, steric and orbital interactions. This section of the course focuses on the properties, preparations, reactions, and interconversions of the various families of organic compounds as well as on the mechanistic details of those transformations.

Prerequisite: CHEM 301.

Textbook: "Organic Chemistry," 6th Ed., Francis A. Carey, McGraw-Hill, New York, NY (2006). ISBN: 0-07-282837-4

Optional material: The textbook by Weeks on "Pushing electrons" is highly recommended. A molecular models kit (available in the bookstore) is also a very good idea to buy either individually or as part of a group. There is an abundance of my past exams/keys as well as worksheets on Blackboard. Use them as you study and prepare for exams. Although the same questions most likely will not appear on your exams, the reserve material gives a good indication of the types of questions that will feature on exams and, more importantly, of the depth of the responses I require

Student Learning Objectives

At the completion of this course students should be able to:

- predict and account for the physicochemical properties of organic compounds based upon their structures. (*GEC 1, 3, 4*)
- account for the behavior of organic compounds and the fates of organic reactions in terms of electronic, steric and orbital interactions. (*GEC 1, 3, 4*)
- describe preparative routes to the main classes of organic compounds (*GEC 4,8*)
- discuss reaction pathways of the main classes of organic compounds (*GEC 1,3,4*)
- draw reasonable curved arrow mechanisms for reactions (*GEC 4,8*)
- outline reasonable synthetic schemes for the interconversions of organic compounds (*GEC 4,8*)
- recognize the importance of redox, C/C bond formation and breakage and functional group interconversions in syntheses (*GEC 4,8*)
- describe the science behind IR, NMR, UV-Vis and MS spectroscopy as well as the fundamentals of the operation of these spectrometers. (*GEC 1,4,6,7,8*)
- utilize an ensemble of spectroscopic data to elucidate the structures of organic compounds (*GEC 1,4,6,7,8*)
- utilize (and account for) wet chemistry to identify organic compounds. (*GEC 1,4,6,8*).

Assessment Methods

Students will be tested using multiple choice, short answer and discussion questions. Assessments will incorporate written discussions, use of curved arrow formalism, quality of synthetic schemes, ability to elucidate the structures of organic molecules from wet chemical and spectral data.

Course Requirements and Evaluation: Students will be required to read and comprehend material covered in class as well as any assigned readings. Students may also be required to turn in written assignments. To get the most out of lectures, students should read the material *prior* to the lecture. There will be 5 hourly tests plus the final (Your lowest hourly test grade will be dropped from your average). Each test that counts to your grade (and the final will be worth 20%). Exams will be held on Friday afternoons at 1:00 p.m (dates given below).

The grading scale is a modified ten point grading scale. Grades will not be curved.

A = 85-100; B = 75-84; C = 65-74; D = 55-64; F = 0-54

Students are strongly encouraged to attend all class meetings. Acceptable excused absences for tests include **only** illness (with a doctor's excuse), university functions, or a death in the immediate family. If you have other problems please contact the instructor prior to the test if possible.

Exam dates: Exams will be held on Fridays at 1:00 p.m. on **Aug 28th , Sep 18th , Oct 9th , 30th , Nov 20th**

Methods of Instruction: Instruction will consist of classroom lectures and discussions, assigned readings, homework and other written assignments.

Course and University Policies:

Americans with Disabilities Act

It is each student's responsibility to register with the Office of Services for Students with Disabilities when requesting an accommodation. Any student with a disability is encouraged to contact the Office of Services for Students with Disabilities, Drew Hall, Room 200, (337) 475-5916 Voice, (337) 475-5878 FAX, (337) 562-4227 TDD/TTY, Hearing Impaired. 475-5722.

A student with a disability is responsible for locating the designated emergency exits, the areas of refuge in a classroom building, and is encouraged to develop and discuss the evacuation plan with the faculty member.

Fire Drill Policy

In compliance with federal regulation 29CFR1910.3, the National Fire Protection Association Standard NFPA 101, Life Safety Code, Section 4.7, and the State of Louisiana Office of Risk Management, McNeese State University will periodically conduct fire drills. In the event of a fire drill or a related building emergency, all persons in a classroom are required to exit the building using posted escape routes or the Area of Refuge for individuals with disabilities. All persons in class are required to follow the faculty member outside of the building to safety and are required to check in with the faculty member to ensure that everyone has safely exited the building. It is everyone's responsibility to ensure that emergency responders such as University Police or Building Coordinators are made aware of missing or injured persons and individuals with

disabilities who evacuated to the Area of Refuge. No one may re-enter the building until an official all-clear is given by emergency responders.

Diversity Awareness Policy

McNeese's policy on Diversity Awareness can be found at

<http://www.mcneese.edu/policy/docs/NonDiscrimination%20Policy%20Revised%20%209-16-08.pdf>

Academic Integrity Policy McNeese's policy on honesty is available at www.mcneese.edu/integrity

Attendance Policy:

Students are **strongly urged** to regularly attend class and review sessions. Attendance will be taken at all lectures.

Course content: A module-based breakdown of the syllabus follows. Emboldened topics are heavily stressed.

Module 1

A Detailed examination of E reactions: kinetics, stereochemistry, stereoelectronic requirements in E2, reaction profiles, factors affecting the partitioning of a reaction among the pathways, the Hammond-Leffler postulate and Zaitsev's rule, exceptions to Zaitsev's rule.

1,1-Eliminations and cyclopropanation.

Polymerization

Module 2

Physical properties alkenes and alkynes. Nomenclature: E/Z terminology, terminal and internal alkenes, dienes, polyenes, isolated, conjugated, cumulated.

Preparations of alkenes: dehydrohalogenation, dehalogenation, dehydration, syn and anti hydrogenation of alkynes.

Preparations of alkynes: dehydrohalogenation, dehalogenation, from lower alkynes

Reactions of alkenes/alkynes: hydrogenation, hydrohalogenation, halogenation, hydration, oxidation (including oxidative cleavage and hydroxylation). Markovnikov/anti-Markovnikov additions and their chemical rationales in terms of electronic/steric/orbital effects.

Module 3

Classifications, physical properties, specific alcohols-methanol, ethanol, isopropyl alcohol, ethylene glycol.

Preparations of alcohols: Markovnikov and anti-Markovnikov hydration of alkenes, reduction of aldehydes and ketones via hydride-transfer and organometallic reagents, hydrolyses of haloalkanes, etc.

Reactions of alcohols: acid/base, conversion to good S_N substrates, silylation, protection-deprotection, acid-base chemistry of alcohols, ethers and oxiranes. Oxidation profile for alcohols. Oxirane ring openings.

Module 4

Organometallic Chemistry: nature of the R group as a function of the metal. Specificities and limitations of Grignard, alkyl lithiums, organocopper reagents.

Module 5

Properties of aldehydes and ketones, selected carbonyl compounds.

Nucleophilic addition, electrophilic assistance, **relative reactivity of isomeric aldehydes/ketones.**

Preparation of aldehydes and ketones: from alcohols, by hydrolysis, from alkynes

Reactions of aldehydes and ketones at the carbonyl C: stereochemical concerns, with standard reagents (including cyanide, ammonia and its deriv's, alcohols, hydride and organometallics). Complementarity of Clemmensen and Wolff-Kishner reductions and that via thioacetals; The Wittig and Baeyer-Villiger reactions.

Reactions of aldehydes and ketones at the α -H: enolate chemistry

Module 6

Allyl chemistry: allyl intermediates – stability and MO diagrams. Free radical allyl substitution.

Diene chemistry: **polar additions, the Diels-Alder reaction, kinetic vs. thermodynamic control.**

Module 7

Identification of Organic Compounds via wet chemistry

Spectroscopic Methods: Includes a semi-detailed overview of the physics and instrumentation of IR, UV-Vis, GC/MS and NMR. **Detailed examination of spectral interpretation.**

Module 8

Conditions for aromaticity, heteronuclear and π -rich aromatic compounds, aromatic ions.

EAS reactions: Friedel-Crafts alkylation/acylation, nitration, halogenation, sulfonation. Sandmeyer reactions. Reactions of the alkyl side chain.

Syntheses using involving reactions above

NAS reactions.

Module 9

Carboxylic acids and their derivatives: preparations, interconversions, Claisen-type reactions.

Examinations and Grading:

There will be five exams (two multiple choice and three discussion-type) during the course of the semester (dates are given above); the lowest grade on those exams will be dropped. Each of the remaining four exams will be worth 20% of your grade (**total = 80%**) and the final (multiple choice) will be worth 20%. **The final will be a standard American Chemical Society (ACS) Organic Chemistry exam.** There will be no make-up exams; if you miss an exam, it will count as the one you drop. **Don't miss more than one.**

Supplementary material:

The textbook (by Solomons) as well as the text by Weeks on "Pushing electrons" are highly recommended. A molecular models kit (available in the bookstore) is also a very good idea to buy either individually or as part of a group. There is an abundance of my past exams/keys as well as worksheets on Blackboard. Use them as you study and prepare for exams. Although the same questions most likely will not appear on your exams, the reserve material gives a good indication of the types of questions that will feature on exams and, more importantly, of the depth of the responses I require.